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(54) **Prefabricated insulating perlite slab of reverse insulation**

Vorgefertigte isolierende Perlitsplatte mit umgekehrter Isolation

Dalle préfabriquée isolante en perlite, à isolation inversée

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(73) Proprietor: **Kotrotsios, Dimitrios**
545 00 N. Thessalonikis T.K. (GR)

(72) Inventor: **Kotrotsios, Dimitrios**
545 00 N. Thessalonikis T.K. (GR)

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Description

[0001] This invention refers to the manufacture of an insulating (heat insulating and waterproofing) perlite slab (tile) of reverse insulation, having as main component the expanded perlite, and which is used for the insulation (heat insulation and waterproofing) of the external surfaces of buildings' reinforced concrete horizontal and sloped external roofs, with usual practicability.

[0002] It consists of the main heat insulating layer, having as main ingredient the expanded perlite, which on its upper side has a first horizontal waterproofing layer, at its lower side has a second horizontal waterproofing layer and at its lateral parts has a perimetrical waterproofing layer.

[0003] Over the first horizontal waterproofing layer, it has a protective waterproofing heat insulating layer and a protective layer of waterproofing cement mortar.

[0004] All the waterproofing layers are protected due to their position, from the adverse weather conditions, the temperature changes of the external environment, from the ultra-violet solar radiation and from mechanical injuries.

[0005] This contributes at the protection of the heat insulation (the insulation success) of the horizontal and sloped external roofs from reinforced concrete and the protection of the reinforced concrete slab, from the infiltration of water in an insulating perlite slab - tile.

[0006] The insulating material used for the construction of the waterproofing layers of the insulating perlite slab - tile is a liquid elastic plaster of two ingredients with mineral elements (cement - expanded perlite or expanded ceramic material with microscopic granulometry 0 to 200 μm) and a large content of elastic resins and synthetic (plastic) materials.

[0007] In order to avoid the creation of thermal bridges and for a lower loss of materials, the perlite slab - tile is manufactured in three types A, B and C.

[0008] Type A is the main insulating perlite slab - tile, which perimetriacally has application grooves for the avoidance of thermal bridges.

[0009] Type B is a supplementary insulating perlite slab - tile, which has a rectangular shape (without application grooves) and is used as terminal slab - tile at the perimeter of the external reinforced concrete roof, where the precise application of the insulating type A slab - tile is not possible.

[0010] Type C is a supplementary insulating perlite slab - tile, which has a rectangular shape (without application grooves) with dimensions equal to the dimensions of every application groove of the type A insulating perlite slab - tile.

[0011] The supplementary Type C insulating perlite slab - tile is used in order to cover the application groove of the Type A insulating perlite slab - tile at the perimeter of the external reinforced concrete, where the precise application of the insulating type A perlite slabs - tiles is

not possible.

[0012] The insulation (heat insulation and waterproofing) of the horizontal and sloped external reinforced concrete roofs, is made with a uniform installation of Type A insulating perlite slabs - tiles at their external surface, with a cementing joint thickness $D=0,2$ to $0,5$ millimeters, with the system of consecutive transversal joints or the system of intermitent transversal joints.

[0013] The cementing between the insulating type A perlite slabs - tiles and with the heat insulating layer of the slopes of the horizontal external roofs or the reinforced concrete slab of the external sloped roofs is made with one or two overcoatings (using a roll or a brush) of the waterproofing material used for the manufacture of the type A, B and C insulating perlite slabs - tiles waterproofing layers.

[0014] At the perimeter of every horizontal or sloped external reinforced concrete roof, on which the precise application of the type A perlite slabs - tiles is not possible.

1. We cover the application grooves of the type A perlite insulating slabs - tiles with the cementing to them of the supplementary type C perlite insulating slabs - tiles, with the waterproofing material used for the manufacture of the waterproofing layers of the types A, B and C perlite insulating slabs - tiles.

2. We use as complementary, parts of the complementary type B perlite insulating slabs - tiles, which are cut with a wheel or a saw and their vertical surface is waterproofed with three or four crisscross coatings, each one (using a roll or a brush).

[0015] In continuation, we cover the remaining part of the external reinforced concrete surface, with the cementing of the complementary type B, perlite insulating slabs - tiles, with the waterproofing material used for the manufacture of the waterproofing layers of the types A, B and C perlite insulating slabs - tiles.

[0016] The expanded perlite is used as a mixture with cement (perlite plaster) for the heat insulation of the external surfaces of the reinforced concrete external roofs with a conventional insulation (construction), as follows :

1. The perlite plaster is prepared on spot at the site.

2. The pumping of the perlite plaster is done with a special press, because the usual presses used for the pumping of the cement plaster do not pump the perlite plaster and they reduce the expanded perlite, resulting in an important decrease of the perlite plaster insulating property.

3. The waterproofing of the perlite plaster surface is made when it dries and tightens, usually after a lapse of eight to fifteen days.

[0017] During this time of eight to fifteen days, the perlite plaster should be protected from rain until its surface

is waterproofed.

[0018] The use of expanded perlite as perlite plaster for the conventional insulation (construction) presents the following disadvantages :

1. Large insulation costs, due to the long works duration of the insulation (heat insulation and waterproofing) and due to the manufacture and pumping of the perlite plaster on spot at the site.
2. The non-effective protection of the heat insulation, because the waterproofing layer is exposed due to its position, to adverse weather conditions, to temperature changes of the external environment, to the ultra-violet radiation and to mechanical damages from the circulation on the external reinforced concrete roof.

[0019] The perlite plaster is water-absorbent and due to the aggravated position of the waterproofing layer, when an infiltration takes place from some place, due to damage on the waterproofing layer, then, the water enters in the entire surface of the perlite plaster (the integral heat insulating layer) resulting in :

- a) The default of the heat insulation in the entire external surface of the horizontal external reinforced concrete roof.
- b) The increase of the building's dead loads, due to the undesirable water weight.
- c) The eventual water infiltration in the internal surface of the horizontal external reinforced concrete roof and its consequences which are usually the development of mould and fungi, and also the damage to the gypsum decorations or the internal plaster.

[0020] The above disadvantages contribute to the diminished use of the expanded perlite in the heat insulation of the external surfaces of horizontal reinforced concrete buildings' roofs.

[0021] The invention EP-A-020303738 (DELZEN JAN HENDRIK VAN) 22 February 1989 (1989-02-22) constitutes a relative infra-structure art for the non-conventional heat-insulation with expanded perlite (with water absorbent heat insulating materials), of the external surfaces of the horizontal and sloped external reinforced concrete buildings roofs.

[0022] This invention refers to the manufacture of an insulating perlite tile which is used for the insulation (heat insulation and waterproofing) of the external surfaces of horizontal and sloped external reinforced concrete buildings' roofs.

[0023] The prefabricated perlite insulating slab - tile consists of a heat insulating layer (-6-, -12-) with main ingredient expanded perlite or polyurethane, whose upper horizontal surface and the two vertical lateral surfaces have a waterproofing layer -13- made of a sheet of synthetic material.

[0024] The bottom horizontal surface of the heat in-

ulating layer (-6-, -12-) has a waterproofing layer -15- from bitumen (tar), that extends also to its lateral vertical surfaces. The slab of EP-A-020 303 738 thus presents all characteristics of the preamble of claim 1.

[0025] The heat insulating layer (-6-, -12-) is also provided with a layer with a metallic sheet -14- of its upper horizontal surface and its lateral vertical surfaces, before the waterproofing layer -13-, evidently for the protection of the heat insulating layer (-6-, -12-) from the strain of the normal practicability and the mechanical injuries.

[0026] My invention refers to the manufacture of an insulating perlite slab - tile of reverse insulation, that neutralizes all the disadvantages of the above invention.

[0027] A prefabricated insulating perlite slab of reverse insulation which consists of a main heat insulating layer which at its upper side has a first insulating horizontal waterproofing layer, at its bottom side has a second horizontal waterproofing layer and at its lateral part has a perimetric waterproofing layer, characterized by the fact that the referred to, perlite slab has above the first mentioned horizontal waterproofing layer, a protective waterproofing heat-insulating layer and a protective layer of waterproofing cement mortar.

[0028] The practical application of the prefabricated insulating perlite slab - tile of reverse insulation to which refers the present invention, presents the following advantages :

1. A lower insulating (heat insulation and waterproofing) cost is achieved, due to the decrease duration of the insulation works.
2. An increased resistance is achieved for the usual practicability (increased resistance in compression) of the insulating perlite slab - tile, due to its protective waterproofing heat insulating layer of the waterproofing cement layer.
3. The efficient protection of the heat insulation is achieved, because all the waterproofing layers of the insulating perlite slab - tile are protected due to their position, against the adverse weather conditions, against the temperature changes of the external environment, against the ultra-violet solar radiation and against mechanical injuries.
4. A uniform and compact (constant) insulating (heat insulation and waterproofing) construction is achieved at the external surfaces of the external reinforced concrete buildings' roofs, without the formation of cracks at the waterproofing layers of every insulating perlite slab - tile, due to the elasticity of the waterproofing material of their construction.

[0029] In order to avoid the creation of thermal bridges and for lower losses of materials, the insulating perlite slab - tile is manufactured in three types A, B and C.

[0030] Type A is the main insulating perlite slab - tile, which perimetrically has application grooves in order to avoid the creation of thermal bridges.

[0031] Types B and C are complementary insulating perlite slabs - tiles and are used as terminal at the perimeter of the external reinforced concrete roofs, where the precise application of type A insulating perlite slabs - tiles is not possible.

[0032] The practical application of the present invention is given in regards to the attached drawings.

[0033] In Drawing 1, we see in vertical cross section the type A of the prefabricated insulating perlite slab - tile.

[0034] In Drawing 2, we see in vertical cross section the type B of the prefabricated insulating perlite slab - tile.

[0035] In Drawing 3, we see in vertical cross section the type C of the prefabricated insulating perlite slab - tile.

[0036] Referring to Drawing 1, the type A of the prefabricated insulating perlite slab - tile consists of the main heat insulating layer -1-, which includes the application grooves -7- and -8- and which has at its upper part a first horizontal insulating layer -4- and at its lower part, a second horizontal insulating layer -6-, of a perimetrical waterproofing layer -5- at its lateral parts, of a protective waterproofing heat insulating layer -2- and of a protective waterproofing cement mortar layer -3-.

[0037] Referring to Drawing 2, the type B of the prefabricated insulating perlite slab - tile consists of the main heat insulating layer -1 α -, which has at its upper part a first horizontal insulating layer -4 α - and at its lower part, a second horizontal insulating layer -6 α -, of a perimetrical waterproofing layer -5 α - at its lateral parts, of a protective waterproofing heat insulating layer -2 α - and a protective layer of waterproofing cement mortar -3 α -.

[0038] Referring to Drawing 3, the type C of the prefabricated insulating perlite slab - tile consists of the main heat insulating layer -1 β -, which has at its upper part a first horizontal insulating layer -4 β - and at its lower part, a second horizontal insulating layer -6 β -, of a perimetrical waterproofing layer -5 β - at its lateral parts, of a protective waterproofing heat insulating layer -2 β - and a protective layer of waterproofing cement mortar -3 β -.

[0039] The type A and B insulating perlite slab - tile is manufactured with the following dimensions :

20x20x12 centimeters, 30x30x12 centimeters, 35x35x12 centimeters, 40x40x12 centimeters, 45x45x12 centimeters and 50x50x12 centimeters.

[0040] Also the same dimensions with a thickness D=5 - 6 - 7 - 8 - 9 - 10 - 11 - 13 - 14 - 15 - 16 and 17 centimeters.

[0041] The application grooves -7- and -8- of the type A insulating perlite slab - tile have a width of L=5 centimeters.

[0042] The type C insulating perlite slab - tile is manufactured with the following dimensions :

[0043] 20x5x6 centimeters, 30x5x6 centimeters, 35x5x6 centimeters, 40x5x6 centimeters, 45x5x6 centimeters and 50x5x6 centimeters.

[0044] Also the same dimensions with a thickness

D=2,5 - 3 - 3,5 - 4 - 4,5 - 5 - 5,5 - 6,5 - 7 - 7,5 - and 8,5 centimeters.

[0045] The insulation (heat insulation and water proofing) of the horizontal and sloped external reinforced concrete roofs, is done with the homogenous installation of type A insulating perlite slabs - tiles at their external surface with a cementing joints' thickness D=0,2 up to 0,5 millimeters, with the system of continuous transversal joints, or with the system of intermittent transversal joints.

[0046] At the horizontal external reinforced concrete roofs, before the installation of the installation of the type A insulating perlite slabs - tiles, the heat insulating layer of the slopes is perimetrically waterproofed at a width L=50 centimeters and the front side of the external horizontal roof at all its height, at the angle between the front and the slopes' heat insulating layer.

[0047] This waterproofing is made with a roll or a brush, in consecutive crisscross layers and using 2 kg/m² of the waterproofing material used for the manufacture of the waterproofing layers of the type A, B and C insulating perlite slabs - tiles.

[0048] The cementing of the type A insulating perlite slabs - tiles among them and with heat insulating layer of the external horizontal roofs' slopes, or with the reinforced concrete slab of the external sloped roofs, is made with one or two coatings (using a roll or a brush), with the waterproofing material used for the manufacture of the waterproofing layers of the type A, B and C insulating perlite slabs - tiles.

[0049] At the perimeter of every reinforced concrete horizontal or sloped external roof, at which the precise application of type A insulating perlite slabs - tiles is not possible :

1. We cover the application grooves -8- of the type A insulating perlite slabs - tiles by cementing on them the complementary the type C insulating perlite slabs - tiles, with the waterproofing material used for the manufacture of the type A, B and C insulating perlite slabs - tiles waterproofing layers.

2. We use as supplements, parts of the complementary type B insulating perlite slabs - tiles which are cut with a wheel or a saw and their vertical surface is insulated with three or four crisscross coats each (using a roll or a brush).

[0050] In continuation, we cover the remaining part of the external surface of the reinforced concrete external roofs, by cementing of the complementary type B insulating perlite slabs - tiles with the waterproofing material used for the manufacture of the waterproofing layers of the type A, B and C insulating perlite slabs - tiles.

[0051] The scope of the present invention is the heat-insulation's protection, at the heat insulation of a usual practicability, of external surfaces of the buildings' reinforced concrete horizontal and sloped external roofs.

[0052] The know how for the manufacture of the type

A, B and C insulating perlite slab - tile of reversed insulation, renders possible the use of water absorbent heat insulating materials for the heat insulation of external surfaces of buildings' reinforced concrete horizontal and sloped external roofs because:

[0053] It transforms the unified water absorbent heat insulating layer of the conventional insulation into small water absorbent heat insulating layers that are waterproofed against each other, against the reinforced concrete slab of the buildings' external roofs, against the terrace parapets, and against external environment, resulting in the heat insulation's protection (the insulation's success).

[0054] The type A, B and C insulating perlite slab - tile heat simultaneously insulates and waterproofs, although its heat insulating layer is water absorbent, because all its waterproofing layers, due to their position, are protected against adverse weather conditions, against temperature changes of the external environment, against ultra-violet solar radiation and against mechanical injuries.

[0055] If the water infiltrates the protective layer of the waterproofing cement mortar (-3-, -3 α -, -3 β -) due to a mechanical injury, it is hemmed in the protective waterproofing heat insulating layer (-2-, -2 α -, -2 β -) of the single insulating perlite slab - tile and if the water infiltrates also the first horizontal waterproofing layer (-4-, -4 α -, -4 β -), it is hemmed in the main heat insulating layer (-1-, -1 α -, -1 β -) of the single insulating perlite slab - tile, resulting in the protection of the heat insulation (the success of the insulation).

[0056] The waterproofing material used for the manufacturing of the waterproofing layers of the type A, B and C insulating perlite slab - tile, are a liquid elastic mortar with mineral elements (cement - expanded perlite or expanded ceramic material with a microscopic granulometry 0 to 200 μ m) with a large content of elastic resins and synthetic (plastic) materials, which in a solid form (when it dries) has the following qualities :

1. It is vapors permeable.
2. It is elastic.

Due to its elasticity, it follows the building's movements and it bridges cracks up to 0,5 millimeters generated by the buildings' mobility, resulting in the non-creation of cracks in the waterproofing layers of every insulating perlite slab - tile.

3. It shows great resistance against low and high temperatures of the external environment (it resists to increased temperature changes), against adverse weather conditions and against the solar ultra-violet radiation.

4. It shows a great adhesion.

Due to its strong adhesion, we obtain a uniform and compact insulating (heat insulating and waterproofing) construction at the external surfaces of the buildings' reinforced concrete external roofs.

5. It shows a great resistance to strong chemical

materials.

[0057] For the construction of the waterproofing layers of the type A, B and C insulating perlite slab - tile, the minimum consumption of waterproofing material is 1,5 kg/m² for the first horizontal waterproofing layer (-4-, -4 α -, -4 β -) and the second horizontal waterproofing layer (-6-, -6 α -, -6 β -) 1 kg/m² for the perimetric waterproofing layer (-5-, -5 α -, -5 β -).

[0058] The main heat insulating layer (-1-, -1 α -, -1 β -) of the type A, B and C insulating perlite slab - tile has a thermal conductivity co-efficient $\lambda=0,052$ w/mK up to 0,93 w/mK.

[0059] Its mass composition is as follows :

- a) 8 to 20 kg of cement.
- b) 100 litres of expanded perlite with a granulometry of 0 to 3 millimeters or 0 to 5 millimeters.
- c) Mortar plastifier, 150 to 200 grams per 100 litres of expanded perlite.
- d) 0,3 to 0,5 kg of multiple application ameliorative (water dispersion emulsion based on elastomeric co-polymeric resins) per 100 litres of expanded perlite.

[0060] The protective waterproofing heat insulating layer (-2-, -2 α -, -2 β -) of the type A, B and C insulating perlite slab — tile has a D=1 to 2 centimeters thickness and thermal conductivity coefficient $\lambda=0,2$ w/mK to 0,4 w/mK.

[0061] Its mass composition is the following :

- a) 40 to 60 kg of cement.
- b) 80 to 100 litres of pumice stone.
- c) 30 kg of water per 100 pumice stone litres.
- d) 3 kg of a mass waterproofing (liquid material based of hydrophobe sulphanic salts in combination with liquefiers) per cubic meter of mixture. or
- e) 3 kg of multiple uses ameliorative (water dispersion emulsion based on elastomeric co-polymeric resins) per cubic meter of mixture.

[0062] An alternative composition of its mass is the following :

- a) 50 to 70 kg of cement.
- b) 100 litres of expanded perlite with a granulometry 0 to 3 millimeters.
- c) 35 kilos of water per 100 litres of expanded perlite.
- d) 3 kilos of mass waterproofing (material based on hydrophobe sulphanic salts in combination with liquefiers) per cubic meter of mixture. or
- e) 3 kilos of multiple application ameliorative (water dispersion emulsion based on elastomeric co-polymeric resins) per 1 cubic meter of mixture.

[0063] The protective layer of the waterproofing ce-

ment mortar (-3-, -3 α -, -3 β -) is the final external surface of the type A, B and C insulating perlite slab - tile and has a D=1 to 3 millimeters thickness.

[0064] Its mass composition is the following :

- a) 1 part of white cement.
- b) 1 to 3 parts of fine marble powder or fine sand.
- c) 3 kilos of mass waterproofing (material based on hydrophobe sulphanic salts in combination with liquefiers) per cubic meter of mixture. or
- d) 3 kilos of multiple application ameliorative (water dispersion emulsion based on elastomeric co-polymeric resins) per 1 cubic meter of mixture.
- e) 300 kilos of water per 1 cubic meter of mixture.

[0065] An alternative composition of its mass is the above composition without the content in marble powder or sand.

[0066] No cracks are formed due to high temperature changes of the external environment on the protective layer of the waterproofing cement mortar (-3-, -3 α -, -3 β -) of the type A, B and C insulating perlite slab - tile, because it is cemented in a protective heat insulating layer (-2-, -2 α -, -2 β -) with a high thermal conductivity coefficient $\lambda=0,2$ w/mK to 0,4 w/mK.

Claims

1. A prefabricated insulating perlite slab (type A, B and C) of reversed insulation, which is composed of a main heat insulating layer (-1-, -1 α -, -1 β -), which on its upper part has a first horizontal waterproofing layer (-4-, -4 α -, -4 β -), on its bottom part, there is a second horizontal waterproofing layer (-6-, -6 α -, -6 β -) and at its lateral parts there is a perimetric waterproofing layer (-5-, -5 α -, -5 β -), **characterized by** the fact that the mentioned insulating perlite slab has a protective waterproofing heat insulating layer (-2-, -2 α -, -2 β -) and a waterproofing cement mortar protective layer (-3-, -3 α -, -3 β -) above the first mentioned horizontal water proofing layer (-4-, -4 α -, -4 β -).

Patentansprüche

1. Eine vorgefertigte isolierende Perlitplatte vom (Typ A, B und C) umgekehrter Isolierung, die zusammengesetzt ist aus einer wärmedämmenden Hauptschicht (-1-, -1 α -, -1 β -), welche auf der oberen Seite eine erste horizontale wasserundurchlässige Schicht (-4-, -4 α -, -4 β -) hat und auf der unteren Seite eine zweite horizontale wasserundurchlässige Schicht (-6-, -6 α -, -6 β -) hat und an den seitlichen Flächen eine perimetrische wasserundurchlässige Schicht (-5-, -5 α -, -5 β -) hat, wird charakterisiert von der Tatsache, daß die erwähnte isolierende Perlit-

platte eine schützende wasserundurchlässige wärmedämmende Schicht (-2-, -2 α -, -2 β -) und eine schützende Schicht aus Zement Mörtel (-3-, -3 α -, -3 β -) auf der erwähnten ersten horizontalen wasserundurchlässigen Schicht (-4-, -4 α -, -4 β -) hat.

Revendications

1. Une dalle isolante (type A, B et C) préfabriquée en perlite, d'isolation inversée, qui est composée d'une couche principale d'isolation thermique (-1-, -1 α -, -1 β -), qui dans sa partie supérieure a une première couche d'imperméabilisation horizontale (-4-, -4 α -, -4 β -), dans sa partie inférieure il existe une deuxième couche d'imperméabilisation horizontale (-6-, -6 α -, -6 β -) et dans ses parties latérales il existe une couche d'imperméabilisation périmétrique (-5-, -5 α -, -5 β -) **caractérisée par le fait que** cette dalle d'isolation en perlite sus-mentionnée a une couche protectrice d'imperméabilisation et d'isolation thermique (-2-, -2 α -, -2 β -) et une couche d'imperméabilisation en mortier de ciment (-3-, -3 α -, -3 β -) au dessus de la première couche d'imperméabilisation sus-mentionnée (-4-, -4 α -, -4 β -).

